

MINE REMOVING SYSTEM

5 The present invention relates to a system for reclaiming mined areas and in particular to an integrated, modular and flexible system for locating, controlling and neutralizing antipersonnel mines.

It is known that the presence of areas strewn with mines or generally with booby traps of any kind, and prepared by one or more belligerents for the sake of
10 offending-defending is a serious humanitarian problem, in particular for the civil populations during and after the termination of conflicts, a problem that turns finally out in an economic burden, involving in addition implications of many-sided nature.

On the other hand, the reclaiming of such areas carried out by human
15 personnel, provided when possible with right special equipment, besides being dangerous to the charged people, it is particularly time-consuming and complex.

The object of the present invention is therefore to propose an integrated system which is safe to the assigned personnel, cheap, quickly feasible and exhaustive with respect to the completeness of the operation.

20 This and other objects and advantages of the system according to the present invention will become more evident from the following specification that refers to a sole drawing, appended as Fig. 1, schematically showing the components of this system.

The proposed system comprises essentially three mutually integrated
25 operating elements, namely: a remote controlled air-means A provided with a maneuverable mechanical arm, a tracked or wheeled terrestrial means T also remote controlled and provided in turn with a mechanical arm, and a further terrestrial means C having manned crew, for the remote survey and a possible corrective intervention on said means in case of need.

30 The remote controlled air-means A is an aircraft with rotating blades (helicopter or the like, capable of hovering), that by operating at low altitude is

able to effect the survey of the underlying ground by means of an electrically or hydraulically operated arm having an action range of about 280° and a nuclearly scanning sensor, able to recognize the nature of the materials forming a buried contrivance M.

5 The remote controlled terrestrial means T, that is usable in different ground situations (such as sands, dunes, rocks, fords, woodlands, town environments) and able to work in the absence of oxygen too and at temperatures comprised between -70°C and +290°C, may be tracked or preferably wheeled with four or six independent driving wheels, each of them being equipped with an autonomous
10 electrically or hydropneumatically operated motor. Said means T, thanks to the presence of autonomous motors for the various wheels, is suited to effect weight changes on each individual axle and is able to self-redress in case of lateral tilting as well as to cruise also in case of total tilting. This terrestrial means T is provided, by analogy with air-means A, with a multifunctional arm articulated on
15 four rotary joints and a 360 degree rotating fifth wheel, on which arm there is mounted an electro-hydraulic telescopic gripper with pressure sensor that is able to determine the consistency of possible bodies to be picked-up and to consequently modify the grasping force without squashing.

 The remote controlled terrestrial means T is provided in addition with a
20 precision small gun, with a relative laying telecamera, that is intended to "shoot" shells formed of solid, semisolid or liquid masses and capable of both undermining from the ground and neutralize booby traps (antipersonnel mines) M, and of stabilizing unsafe structures by demolishing the endangered parts. The presence of the various named equipment gives to this remote controlled means T
25 a particular versatility, in that it can also be used to extinguish fire centers and fires in progress, to down doors in case of rescues, to pick up inert people in dangerous situations, to salvage wounded persons from dangerous environments owing to the presence of poison gases, as anti-rebellion means, and so on.

 In summary, the remote controlled terrestrial means is provided with:
30 a displacement controlling telecamera; inside propelled wheels; a multifunctional arm; an arm - and propulsion-controlling electronic gearcase; an

electrohydraulic compressor; a double independent circuits system; means-guiding and gun-aiming boards; telesurveying and data reception antennas; various protective platings and screenings; various containers and reservoirs.

5 The terrestrial means C with manned crew is provided with short-range radio instrumentation for the telesurveying and mapping of the territory, also based on the info received from the other system components, and constitutes the control and check component of the system.

10 One of the peculiar characteristics of the system according to the present invention is the possibility of sensing in the ground also the presence of small sized mines with non-metallic (for example plastics) shell, that are mainly used with an anti-personnel function. This is possible thanks to a nuclear scanning of the materials as allowed by sophisticated computerized programs.

15 A further important peculiarity of the system at issue is the undermining technique which is applied, besides with mechanical drilling and grasping means, also with ballistic, hydraulic or hydromechanical means, wherein the undermining and neutralizing action is carried out by a violent (explosive) ejection of fluid (e.g. aqueous) means directed through the ground on the object to be removed. The apparatus intended for this purpose uses a fire-producing propellant (such as ballistite) that imparts the required penetration force to a liquid (aqueous) mixture
20 which is ejected through a suitably sized nozzle. As an alternative to the fire-producing propellant, a high pressure mixed propellant can be used in connection with a powerful compressor.

25 Although a particular structure of the mine removal system according to the present invention has been described, it is clear that possible changes may be introduced in it without distorting its spirit and substance. It will thus be possible to substitute for the air-means A with rotating blades a suitably equipped air-balloon, which is particularly useful, not to say necessary, in woodland and/or rocky areas, and the like, where the use of an helicopter would be dangerous or impracticable.

30 A further change to the operating system of the present invention would concern not only the operational modes, but also the applicative aims. It would

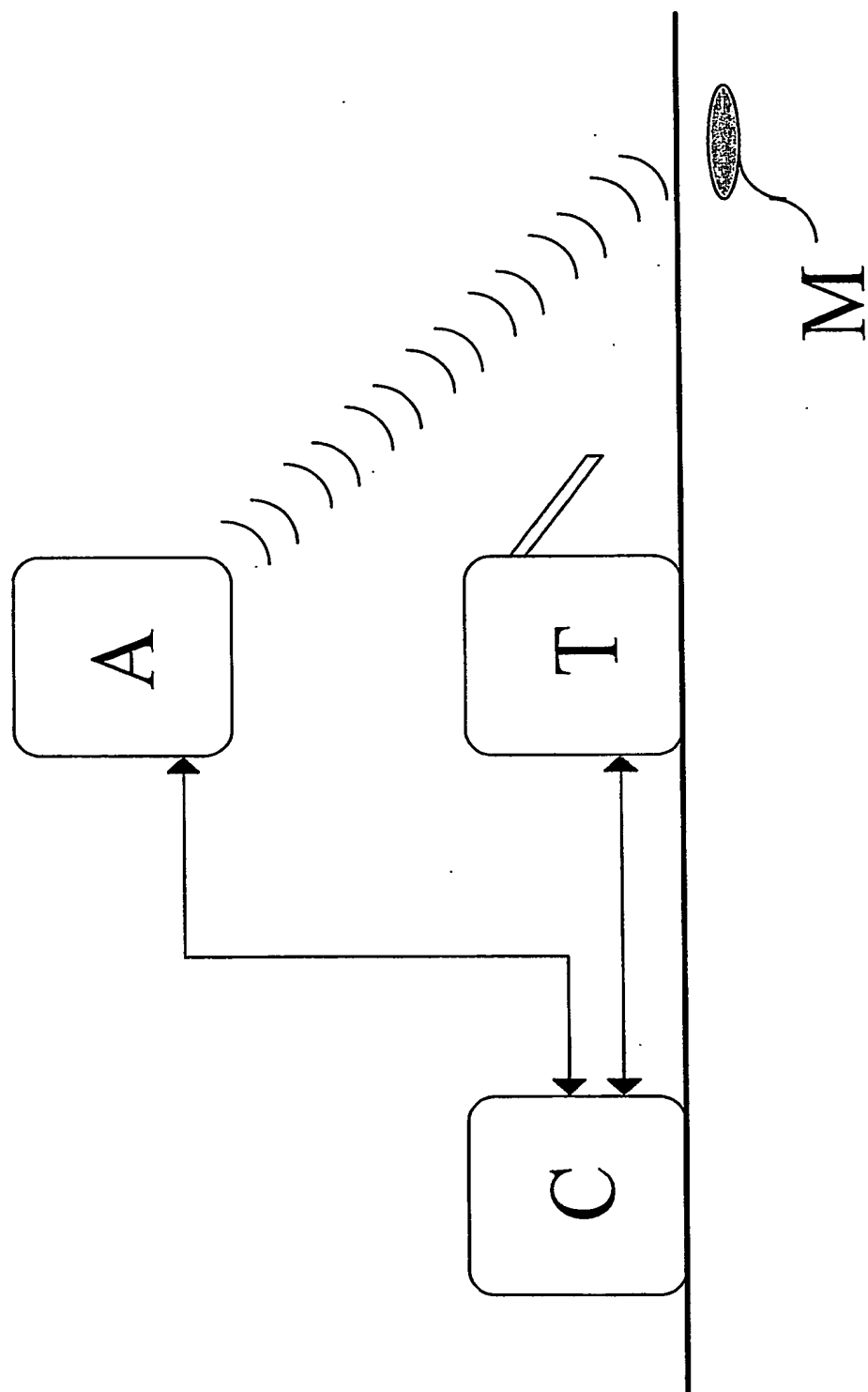
thus be possible to use the fundamental equipment in fields such as the archaeological, botanical, architectural research, in medicine, and so on.

In summary, the peculiar features of the proposed system are:

- absolute safety for the operators;
- 5 - low practice costs with respect to the presently used systems;
- extremely high operating rapidity;
- advanced and specific driving and controlling software programs.

CLAIMS

1. A mine removal system in mined areas, characterized in that the system is substantially formed by three independent and co-ordinated modular units (C, A, T).
2. The removal system according to claim 1, characterized in that the three modular units are respectively formed by a remote controlled air-means (A) acting above the ground; a remote controlled self-propelled terrestrial means (T), and an autonomous terrestrial means (C) with manned crew.
3. The removal system according to claim 2, characterized in that said air-means (A) is provided with surveying and locating devices of visible or buried things (M) independently of the nature of the materials forming them; said remote controlled terrestrial means (T) is provided with devices suited to undermine buried things; and said autonomous terrestrial means (C) is provided with telesurveying radio devices.
4. The removal system according to claim 2, characterized in that said devices suited to undermine comprise nozzles from which a liquid means is ejected under high pressure.

Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No.

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 F41H11/12 F41H11/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 F41H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	PATENT ABSTRACTS OF JAPAN vol. 2002, no. 10, 10 October 2002 (2002-10-10) & JP 2002 168623 A (JAPAN SCIENCE & TECHNOLOGY CORP), 14 June 2002 (2002-06-14) abstract	1-3
X	DE 44 17 262 A (DAIMLER-BENZ) 23 November 1995 (1995-11-23)	1-3
Y	abstract column 2, line 61 -column 3, line 4; figure 1	4
Y	US 6 026 135 A (MCFEE ET AL.) 15 February 2000 (2000-02-15) column 7, line 57 -column 8, line 17; figures 1,2	1,2
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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INTERNATIONAL SEARCH REPORT

Intel: nal Application No

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C.(Continuation) DOCUMENTS CONTAINED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>HEWISH M ET AL: "TREADING A FINE LINE: MINE DETECTION AND CLEARANCE COMBATING MINES:TACTICAL AND HUMANITARIAN EFFORTS" JANE'S INTERNATIONAL DEFENSE REVIEW, JANE'S INFORMATION GROUP, GB, vol. 30, 1 November 1997 (1997-11-01), pages 30-32,34-38,, XP000734915 ISSN: 0020-6512 page 31; figure 1 page 36, left-hand column, line 10 - line 16 page 36, right-hand column, line 26 -page 37, left-hand column, line 5</p>	1,2
Y	<p>"WATER JET SYSTEM COULD DEACTIVATE BATTLEFIELD LAND MINES" NTIS TECH NOTES, US DEPARTMENT OF COMMERCE. SPRINGFIELD, VA, US, 1 August 1992 (1992-08-01), page 555 XP000325246 ISSN: 0889-8464</p>	4
A	<p>the whole document</p>	1-3
A	<p>PATENT ABSTRACTS OF JAPAN vol. 2000, no. 09, 13 October 2000 (2000-10-13) & JP 2000 171198 A (NEC CORP), 23 June 2000 (2000-06-23) abstract</p>	1-4
A	<p>EP 0 230 720 A (EVANS DEAKIN) 5 August 1987 (1987-08-05)</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2002168623	A	14-06-2002	NONE	
DE 4417262	A	23-11-1995	DE 4417262 A1	23-11-1995
US 6026135	A	15-02-2000	US 6215122 B1	10-04-2001
			US 6203846 B1	20-03-2001
JP 2000171198	A	23-06-2000	NONE	
EP 230720	A	05-08-1987	AU 589226 B2	05-10-1989
			AU 6455486 A	07-05-1987
			EP 0230720 A2	05-08-1987
			AT 71053 T	15-01-1992